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as per
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between and around the plies of the preform; and
curing the preform to form a near net shape article.

REMARKS

This response is filed in response to the Office Action dated May 6, 2002.

Upon entry of this response, claims 1-9, 11-14 and 18 will be pending in this Application.

In the outstanding Office Action, the Examiner required restriction between claims 1-14 and 18 and claims 15-17, rejected claims 7, 8, 10 and 11 under 35 U.S.C. 112, rejected claims 1-4, 6, 8, 10-12, 14, and 18 under 35 U.S.C. 102, and rejected claims 1-14 and 18 under 35 U.S.C. 103.

Requirement of Restriction

The Examiner required a restriction to one of the following invention under 35 U.S.C. 121:

- I. Claims 1-14 and 18 drawn to a method of preparing a preform classified in class 156, subclass 166.
- II. Claims 15-17, drawn to an apparatus for applying a discontinuous pattern of a tackifier in the manufacture of a preform, classified in class 264, subclass 517.

Applicant hereby affirms the election of Group I directed to a method. Furthermore, claims 15-17 have been cancelled by Applicant in this Response, thereby rendering the restriction requirement moot.

Rejection under 35 U.S.C. 112

The Examiner rejected claims 7, 8, 10 and 11 under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Specifically, for claims 7 and 8, the Examiner stated:

The term "about" is a relative term which renders the claim indefinite. The term "about" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention.

Applicant respectfully traverses the Examiner's rejection. MPEP 2173.05(b) provides that "[t]he term 'about' used to define the area of a mold as between 25 to about 45% of the mold entrance was held to be clear, but flexible." *Ex parte Eastwood*, 163 USPQ 316 (Bd. App. 1968). Similarly, "a quantity of about ¼ percent to about 10 percent of the areal weight of the reinforcing fiber" in claim 7 and "a quantity of about 30 volume percent to about 40 volume percent" in claim 8 are clear, but flexible. Both quantities are explicitly disclosed at page 7, lines 4-7 in the specification. Further, Applicant asserts that one skilled in the art would know what amounts are included in the claims and that such objectively measurable parameters would provide a basis for one of ordinary skill in the art to both ascertain the requisite degree and be reasonably apprised of the scope of the invention.

For claim 10, the Examiner stated, similar to claims 7 and 8 for the term "about", that the term "effective" renders the claim indefinite. In response thereto, claim 10 has been cancelled herein, thereby rendering the rejection thereagainst moot. Additionally, claims 1 and 18 have been amended to incorporate claim 10 in a manner believed to overcome the rejection.

The Examiner rejected claim 11 as being "incomplete for omitting essential steps, such omission amounting to a gap between the steps;" the omitted steps being: the steps for preparing the tackified reinforced fibers for shipping. In response thereto, claim 11 has been amended in a manner believed to overcome the rejection.

In view of the above, it is submitted that claims 7, 8, 10 and 11 comply with 35 U.S.C. 112, second paragraph and are therefore allowable.

Rejection under U.S.C. 102

The Examiner has rejected claims 1, 4, 6, 8, 10, 14 and 18 under 35 U.S.C. 102(b) as being anticipated by United States Patent No. 5,480,603 issued to Lopez, hereinafter "Lopez".

The present invention as recited in independent claims 1 and 18 is directed to a method for preparing a preform. The method includes forming a layer of reinforcing fibers and applying a patterned discontinuous layer of tackifier resin to at least one side of the layer of reinforcing fibers. A predetermined quantity of the tackifier resin is forced into a number of fibers. Finally the tackifier resin is cured.

Lopez, as understood, is directed to a method for preparing preforms which comprises

(1) applying an aqueous dispersion of a tackifier onto one or more reinforcement fibers, (2) drying the coated reinforcement fibers to remove the water present and (3) forming one or more of the coated reinforcement fibers into a predetermined shape.

See col. 1, lines 56-61. The aqueous dispersion applies "a substantially uniformly distributed tackifier on the surface" of the fiber layer "in the form of a discontinuous film coating." See col. 2, lines 12-14.

In rejecting claim 1, the Examiner states:

Lopez is directed towards a method of applying a discontinuous coating to hold together reinforcement fibers, for use in an RTM molding process. The discontinuous coating can be considered to be a random pattern.

Applicant respectfully traverses this rejection. As summarized above, Lopez utilizes an aqueous dispersion which *substantially uniformly distributes* the tackifier. (*emphasis added*) It is upon the removal of water from the dispersion that the discontinuous film coating is achieved. As stated in one of the embodiments:

A visual examination of the dried coated plies reveals a substantially uniformly distributed discontinuous film coating of the tackifier on their surfaces.

See col. 7, lines 56-59. Applicant asserts that Lopez *applies* a substantially uniform layer of tackifier in aqueous dispersion. This is not the present invention as recited in independent claims 1 and 18 which recite "applying a patterned discontinuous layer of a tackifier resin." Furthermore, Lopez does not teach or suggest a "patterned" discontinuous layer. While Lopez discusses a resulting discontinuous layer, after drying of the aqueous dispersion of tackifier, Lopez does not discuss a "patterned" discontinuous layer. The Examiner makes reference to a

"random pattern" in the rejection, but does not explain the meaning of "random pattern."

Applicant does not understand how a coating can be considered random and having a pattern at the same time. The formation of the discontinuous coating as a result of a drying process prevents the formation of a pattern because discontinuities cannot be controlled. Thus, for the reasons given above, Lopez does not teach or suggest all of the limitations of independent claims 1 and 18 and thus cannot anticipate independent claims 1 and 18.

The Examiner rejected claims 4, 6, 8, 10 and 14 stating:

With regard to claim 4, Lopez shows that the tackifier resin is applied using a spray bottle. (col. 7, lines 48-53)

With regard to claim 6, Lopez teaches using the claimed tackifier resins in the preparation of the reinforced fibers (col. 2, lines 50-67)

With regard to claim 8, Lopez recites the volume percentages of the tackifier resin (col. 4, lines 1-14)

With regard to claim 10, Lopez states that the amount of tackifier applied to the substrate should be sufficient to hold the fibers in the desired shape and position (col. 5, lines 5-11)

With regard to claim 14, Lopez teaches that the purpose of the process is to prepare a preform for an RTM molding process (col. 2, lines 15-17)

With regard to claim 18, Lopez and Alderfer show that a discontinuous, patterned layer of tackifier resin is applied to the fibers in a predetermined amount to form a tacky ply as mentioned in the rejection for claim 1.

Claims 4, 6, 8, and 14 depend from claim 1 which Applicant believes to be distinguishable from Lopez for the reasons given above and include further limitations from Lopez and are believed to be allowable for the reasons given above. Applicant has cancelled claim 10 without prejudice herein, thereby rendering the rejection thereagainst moot.

The Examiner rejected claim 18 stating:

Lopez and Alderfer show that a discontinuous, patterned layer of tackifier resin is applied to the fibers in a predetermined amount to form a tacky ply.

Applicant respectfully traverses the Examiner's rejection. As previously discussed, Lopez fails to disclose applying a patterned discontinuous coating of adhesive tackifier resin. A discussion of Lopez and Alderfer will follow in the discussion of the 103 rejection.

Therefore, for the reasons given above, claim 18 is believed to be allowable.

Rejection under U.S.C. 103

The Examiner has rejected claims 1-4, 6, 8-14 and 18 under 35 U.S.C. 103(a) as being unpatentable over Lopez in view of Alderfer (United States Patent No. 2,207,279 issued to Alderfer, hereinafter "Alderfer").

The Examiner rejected claims 1 and 18 stating:

With regard to claim 1, Lopez is directed towards a method of applying a discontinuous coating to hold together reinforcement layers, for subsequent use in an RTM molding process. Alderfer is directed towards applying resin to hold warp strands in various shapes (Lopez, col. 1, lines 8-20, col. 5, lines 5-11 and Alderfer col. 3, lines 20-35).

At the time of the invention, it would have been obvious to one of ordinary skill in the art to have applied the resin in a patterned arrangement, as is taught by Alderfer, to the reinforcing fibers of Lopez in order to apply only a sufficient amount of resin as was needed so that the strands or fibers would stick together before molding.

With regard to claim 18, Lopez and Alderfer show that a discontinuous, patterned layer of tackifier resin is applied to the fibers in a predetermined amount to form a tacky ply.

Applicant respectfully traverses the Examiner's rejection. As previously discussed, Lopez discloses an aqueous dispersion of tackifier resin that is substantially uniformly applied. The tackifier resin only acquires its discontinuous characteristics after its aqueous carrier medium, namely water, evaporates. This is not Applicant's invention. The present invention applies a patterned, discontinuous layer as recited in claims 1 and 18 without the need to evaporate an aqueous carrier to permit formation of the discontinuous tackifier layer as discussed in Lopez.

Alderfer, as understood, discloses a method for making cord fabric for use with pneumatic tires. A roll of adjacent parallel strands of cord fabric are secured in position by

application of viscous material to one surface of the fabric. The viscous material is allowed to dry on the fabric surface prior to being wound on a take-up roll forming a fabric strip. Alderfer further discloses:

In the rubber industry the fabric may be impregnated with rubber composition and then coated with unvulcanized rubber in a calender as is well known in the art. It is then bias-cut into smaller pieces of proper length and width and built into the carcasses of pneumatic tire casings.

See Alderfer col. 3, lines 8-12. Figs. 3 and 4 illustrate a tire casing before vulcanizing and after vulcanizing, respectively. See col. 3, lines 14-19.

Alderfer does not disclose an RTM process. RTM, which is an acronym for resin transfer molding, is defined in Applicant's specification as follows:

Layers of reinforcing material of a predetermined shape, known as preforms, are loaded into a mold, and a thermosetting or EM wavelength activated resin binder is injected into the mold and cured by known procedures to provide a finished part.

See Applicant's specification page 1, lines 16-20. Alderfer fails to disclose any type of injection operation, much less such an operation occurring once the preforms are loaded into a mold. More specifically, the impregnation of fabric and coating with unvulcanized rubber in a calender as is well known in the art is confined to the compressive effect provided by the calender. Since Alderfer is not directed to an RTM molding process, it is non-analogous art and improper for the Examiner to cite Alderfer, either by itself or in combination with other references against any of the claims of the present invention. Further, the purpose for the coating (bond 11) in Alderfer was to secure adjacent cords together for subsequent processing; that is to create a weftless cord fabric without the cost normally associated therewith. See Alderfer col. 1, lines 18-24 and Fig. 1. Since the fibers in the present invention irrespective of the type (uni-directional, bi-directional and random) are already secured within the formed fiber layer prior to the application layer of tackifier, the application of coating in Alderfer is superfluous and teaches away from the present invention.

Furthermore, assuming for argument purposes only that Lopez and Alderfer are combinable, the Examiner has not provided any teaching or suggestion in either Lopez or

Alderfer that would direct one skilled in the art to make such a combination. The Examiner has not cited any passage in Lopez teaching or suggesting the desirability of using a "patterned" coating nor has the Examiner cited any passage in Alderfer that would teach or suggest the desirability of using a discontinuous coating or an RTM molding process. Thus, since the Examiner has provided no teaching or suggestion for making the combination, Applicant submits that the Examiner has made the combination based on Applicant's own teaching, which is impermissible hindsight reasoning by the Examiner.

Thus, for the reasons given above, claims 1 and 18 are believed to be allowable.

Claims 2-4, 6, 8, 9 and 11-14 depend from claim 1 which Applicant believes to be distinguishable from Lopez and Alderfer for the reasons given above and include further limitations from Lopez and Alderfer and are believed to be allowable for the reasons given above. Applicant has cancelled claim 10 without prejudice herein, thereby rendering the rejection thereagainst moot.

Rejection under U.S.C. 103

The Examiner has rejected claims 5 and 7 under 35 U.S.C. 103(a) as being unpatentable over Lopez in view of Alderfer and the admitted prior art.

Claims 5 and 7 depend from claim 1 which Applicant believes to be distinguishable from Lopez and Alderfer for the reasons given above and include further limitations from Lopez and Alderfer and are believed to be allowable for the reasons given above.

Rejection under U.S.C. 103

The Examiner has rejected claim 3 under 35 U.S.C. 103(a) as being unpatentable over Lopez and Alderfer in view of United States Patent No. 6,096,669 issued to Colegrove et al., hereinafter "Colegrove." The Examiner states:

Colegrove discloses applying the tackifier resin by a release sheet. At the time of the invention one of ordinary skill in the art would have used a release sheet so that the fibers would not be damaged.

Colegrove, as understood, discloses a method of applying a resin film grid from a release paper to each side of a unidirectional layer of fibers. Opposed heated rollers 14 are spaced apart to apply "sufficient pressure for the layers of resin film grid 8 (softened by the heated rollers) to be transferred to both sides of the unidirectionally aligned fibers 10." See col. 4, lines 9-12. The fibers then pass over a heated platen 15 to melt the resin on the fibers, resulting in a unidirectional fiber tape. The fiber tape is then passed through a pair of "nip" rollers which removes one of the release papers prior to rolling the fiber tape onto a take-up roller.

Claim 3 depends from claim 1, which is believed to be allowable for the reasons given above, and is believed to be allowable as depending from an allowable claim 1.

Rejection under U.S.C. 102

The Examiner has rejected claims 1-3, 10-12, 14 and 18 under 35 U.S.C. 102(e) as being anticipated by Colegrove.

The Examiner rejected claim 1 stating:

Colegrove discloses aligning fibers in order to form at least one layer (col. 3, lines 62-65). Next a resin grid film on release paper is applied to one or both sides of the fibers (Figure 3). The resin, which is polymeric curable, is in the form of grid such that only a fraction of the surface area of the fibers contact the curable resin film grid (discontinuous layer) (Figures 1-3 and col. 2, lines 50-67 and col. 3, lines 41-58). PR500® may be used as a resin in combination with PT500® epoxy resin, which is a powdered tackifier (col. 3, lines 32-42).

As amended, claim 1 has been further clarified to recite applying a patterned discontinuous layer of a tackifier resin to at least one side of the layer of reinforcing fibers "wherein a predetermined quantity of the tackifier resin *is forced into* a number of the fibers." Disclosure of applying pressure sufficient to force the tackifier resin into the fiber layer is lacking in Colegrove. As disclosed in Colegrove above, opposed heated rollers 14 are spaced to apply sufficient pressure to *transfer* the film grid 8 to the fibers. Further, although subsequent heat is applied to the combined fiber layer sandwiched between film grids by a heated platen 15, the purpose the heated platen is "to melt the resin on the fibers, resulting in a unidirectional fiber tape." See col. 4, lines 12-16 and Figure 2. In another embodiment of Colegrove, although a

heated pressure sled 24 is disclosed that moves back and forth along the fiber direction, the heat and pressure from sled 24 is merely to "cause non-woven random mat 20 to adhere to unidirectional fiber tape 16. See col. 4, lines 40-44 and Figures 4 and 5. In other words, where heat and pressure are disclosed in Colegrove, not only are multiple film grids being transferred to the fiber layer, but multiple fiber layers are being bonded together. In the present invention, a single fiber layer is contemplated with the rollers being "positioned such that the contact of the patterned roller with the reinforcing fibers is sufficient to force some of the resin into the fibers themselves." See page 8, lines 23-24. Applicant asserts that any application of temperature or pressure by any combination of rollers, platen or sled disclosed in Colegrove fails to disclose forcing resin *into* the fibers, and more specifically, that use of the sled was due to the multiple layers of resin and fibers being applied and joined, versus the application of resin in the present invention to a *single* layer of fiber. Lacking such disclosure, the Examiner cannot state this was expected to occur, as it could also be argued that the resin could merely be more evenly spread between adjacent fiber layers.

Thus, Applicant submits that since Colegrove does not teach or suggest all of the limitations of independent claim 1 that Colegrove cannot anticipate independent claim 1 and is therefore allowable.

The Examiner rejected claim 2 stating:

Colegrove shows that the patterned layer of tackifier resin is applied by a patterned roller. Col. 2, lines 41-57.

Applicant respectfully traverses the Examiner's rejection. Claim 2 depends from claim 1, which is believed to be allowable for the reasons given above, and is believed to be allowable as depending from an allowable claim 1. Although an imprint roller 7 provided with various patterns is utilized to apply a film grid 8 to release paper 6, it is the film grid 8 on release paper 6 that is applied to fiber layer 10 during the fabrication process, not the roller 7. That is to say, roller 7 is limited to producing the film grid 8; the film grid 8 is *applied* by a release sheet. Since all embodiments of the process disclose application of the film grid 8 by release paper 6, especially in light of specific disclosure for forming film grid 8 onto release paper 6 (col. 2, lines 41-57), Applicant asserts that without contrary disclosure in Colegrove, it was not contemplated

to eliminate the separate steps of applying film grid 8 onto release paper 6, and that applying a patterned discontinuous layer using a patterned roller is not anticipated by Colegrove.

Claims 3, 11, 12 and 14 depend from claim 1 which Applicant believes to be distinguishable from Colegrove for the reasons given above and include further limitations from Colegrove and are believed to be allowable for the reasons given above. Applicant has cancelled claim 10 without prejudice herein, thereby rendering the rejection thereagainst moot.

The Examiner rejected claim 18 stating:

Colegrove discloses forming a layer of reinforcing fibers and applying a coating of tackifier curable-resin to at least one of the sides of the reinforcing fibers as noted above. Colegrove also goes on to say that after the tackifier resin is applied to the reinforcing fibers the individual plies may be shaped and the preform may then be molded. The preform is manufactured such that fibers have a resin content which is sufficient to hold the fibers in a desired shape but also small enough to leave the resulting preform porous so that it can be impregnated with matrix resin during subsequent molding processes (col. 1, lines 39-47 and col. 5, lines 49-59). One would expect this matrix resin to be in liquid form so it could penetrate through the pores of the preform.

As previously discussed, claim 18 has been amended to clarify the patterned discontinuous coating of adhesive tackifier resin being applied in a predetermined amount to at least one side of the layer of reinforcing fibers "wherein a portion of the predetermined amount of the tackifier resin being forced into a number of fibers." Also as previously discussed, Applicant asserts that any application of temperature or pressure by any combination of rollers, platen or sled disclosed in Colegrove fails to disclose forcing resin *into* the fibers, and more specifically, that use of the sled was due to the multiple layers of resin and fibers being applied and joined, versus the application of resin in the present invention to a *single* layer of fiber. Lacking such disclosure, the Examiner cannot state that it is expected for this matrix resin to penetrate through the pores of the preform since the matrix resin is in liquid form, as it could also be argued that the resin could merely be more evenly spread between adjacent fiber layers.

Thus, for the reasons given above claim 18 is believed to be allowable.

Rejection under U.S.C. 103

The Examiner has rejected claims 7, 9 and 13 under 35 U.S.C. 103(a) as being unpatentable over Colegrove.

Claims 7, 9 and 13 depend from claim 1 which Applicant believes to be distinguishable from Colegrove for the reasons given above and include further limitations from Colegrove and are believed to be allowable for the reasons given above.

Rejection under U.S.C. 103

The Examiner has rejected claims 4-6 and 8 under 35 U.S.C. 103(a) as being unpatentable over Colegrove in view of Lopez and Alderfer.

Claims 4-6 and 8 are believed to be allowable as depending from what is believed to be allowable claim 1 for the reasons given above.

Further, it is clear that the Examiner can arrive at this combination to achieve Applicant's invention only after exposure to Applicant's invention. In the absence of a motivation or suggestion, Applicant submits that the combination of Colegrove, Lopez and Alderfer to purportedly achieve Applicant's invention can only be reached by use of impermissible hindsight. The references must be used without the benefit of hindsight afforded by the claimed invention.

Therefore, for the reasons given above, Applicant submits that claims 4-6 and 8 are not obvious over Colegrove in view of Lopez and Alderfer.

Objection to the Specification

The Examiner objected to the disclosure because of an informality. In response thereto, the specification has been amended in a manner believed to overcome the objection.

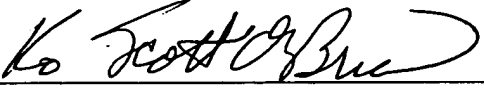
CONCLUSION

In view of the above, Applicant submits claims 1-9, 11-14 and 18 are not anticipated, rendered obvious in view of Lopez, Alderfer, Colegrove or any combination thereof. Thus,

Applicant requests the withdrawal of the outstanding objections and rejections and allowance of claims and issuance of the application. A timely and favorable action is earnestly solicited.

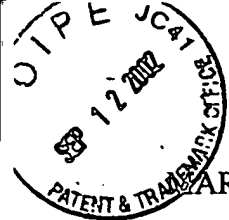
Should the Examiner have any questions with respect to any matter now of record, the Examiner is requested to contact the undersigned at the phone number listed below.

Respectfully submitted

By: 

Dated: September 6, 2002

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MARKED UP VERSION OF THE SPECIFICATION

On page 9, lines 12-26, please amend the paragraph beginning with "In a different" as follows:

In a different embodiment, rather than a supply roller 20 and patterned roller 18, the applicator 24 comprises at least one spray [spay] nozzle (not shown) positioned to spray a patterned discontinuous layer of tackifier onto the passing reinforcement fibers. This discontinuous spray may be controlled by, for example, a patterned nozzle head, a predetermined movement of the nozzle, a predetermined variation in flow amount or a combination of the above. The nozzle receives a constant supply of tackifier through, for example, a supply tube. Typical spray patterns of this type are well known and used in the construction industry to laminate thin layers of board. An epoxy resin used as an adhesive is pressurized to about 30 psi and supplied to the spray nozzle. The spray nozzle dispenses the epoxy resin in a narrow stream. During the dispensing operation, the nozzle oscillates back and forth in a regular motion. This creates a regular pattern of resin on top of the board. When complete, there is a regular but discontinuous pattern of epoxy resin adhesive deposited on the board. This pattern significantly reduces the amount of adhesive resin required for bonding boards together.

MARKED UP VERSION OF THE CLAIMS

1. (Amended) A method of preparing a preform for a RTM molding process comprising the steps of:

forming a layer of reinforcing fibers;

applying a patterned discontinuous layer of a tackifier resin to at least one side of the

layer of reinforcing fibers, wherein a predetermined quantity of the tackifier resin

being forced into a number of the fibers; and

curing the tackifier resin.

11. (Amended) The method of claim 1 further comprising the step of preparing the tackified reinforcing fibers for shipping.

18. (Amended) A method of preparing [of preparing] a fiber-reinforced composite article for use in a gas turbine engine, comprising the steps of:

forming a layer of reinforcing fibers;

applying a patterned discontinuous layer of adhesive tackifier resin in a predetermined

amount to at least one side of the layer of reinforcing fibers to form a tacky ply, wherein

a portion of the predetermined amount of the tackifier resin being forced into a number of the fibers;

assembling a plurality of the plies to form a preform, the predetermined amount of adhesive tackifier resin being sufficient to maintain the assembled plies in a shape of the preform;

placing the preform in a mold; then

injecting a second resin in liquid form into the mold to form a continuous matrix of resin between and around the plies of the preform; and

curing the preform to form [from] a near net shape article.